

GENETIC INVENTORY WESTSLOPE CUTTHROAT TROUT 9501600

SHORT DESCRIPTION:

Conduct a genetic inventory of westslope cutthroat trout in the North Fork Clearwater River Drainage to determine the extent of introgression by introduced Yellowstone cutthroat trout, rainbow trout, and golden trout.

SPONSOR/CONTRACTOR: NPT

Nez Perce Tribe

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SUB-CONTRACTORS:

University of Montana

GOALS

GENERAL:

Supports a healthy Columbia basin, Maintains biological diversity, Maintains genetic integrity, Increases run sizes or populations

RESIDENT FISH:

Research, M&E

NPPC PROGRAM MEASURE:

10.3C.4;10.3C.5

RELATION TO MEASURE:

Measure 10.3C.4 specifically calls for a genetic inventory in the North Fork River drainage to determine the genetic status of the native westslope cutthroat trout, including introgression with rainbow trout. This matches the intent of the project. Measure 10.3C.5 authorizes BPA to fund the project

TARGET STOCK

Westslope cutthroat trout

LIFE STAGE

MGMT CODE (see below)

W, RSH

AFFECTED STOCK

Bull trout

BENEFIT OR DETRIMENT

Beneficial

BACKGROUND

Stream name:

North Fork Clearwater River and Tributaries

Subbasin:

Clearwater River

Land ownership:

public

Hydro project mitigated:

Dworshak Dam and Reservoir, Idaho

HISTORY:

The NPPC approved the authorizing measure for project 9501600 based on recommendations from project 8740700. Authorization of this project by the NPPC required interagency consultation and concurrence with the Idaho Department of Fish and Game, National Marine Fisheries Service, Bonneville Power Administration, Bureau of Reclamation and Corps of Engineers.

BIOLOGICAL RESULTS ACHIEVED:

Available data from literature and references have been summarized. Studies into current fish distribution classified several streams as suspected introgression, suspected pure, and complete replacement by rainbow trout, and documented the locations of fish barriers on 49 streams in the drainage. Many of these fish barriers had westslope cutthroat trout populations above them, indicating protection from upstream migrating rainbow trout. Stocking histories for the drainage were compiled from Idaho Department of Fish and Game records, and have been preliminarily related to fish distribution in specific areas of the drainage. After submitting proposals for genetic methodology, a sub-contractor was engaged in November 1996 to begin work on the

genetic reference samples.

ADAPTIVE MANAGEMENT IMPLICATIONS:

Intensive fish distribution and stocking history research will be used in the experimental design during reference sample development, site selection, and interpretation of the genetic data. The genetic information gained from this project will provide program direction for simultaneously mitigating for resident fish losses and conserving declining native fish species (westslope cutthroat trout, bull trout). This project will provide the opportunity to adaptively manage the Dworshak resident fish mitigation program. The knowledge gained from this project can be applied to other regions of the Columbia basin.

PURPOSE AND METHODS

SPECIFIC MEASUREABLE OBJECTIVES:

Determine the extent of introgression to westslope cutthroat trout by exotic trout in the drainage, and reestablish genetically pure populations of native westslope cutthroat trout throughout the North Fork Clearwater River drainage by supporting the development of a native westslope cutthroat trout broodstock derived from local populations for resident fish mitigation. The conservation objective is to maintain (at least) minimum populations of 150-300 individuals and >95% probability of persistence for at least 5 generations. The utilization objective is an interim sustainable harvest rate of .5 fish/hr.

CRITICAL UNCERTAINTIES:

Introgression in the drainage has/has not progressed to the point of being non-reversible.

BIOLOGICAL NEED:

Hybridization with exotic trout is the greatest threat to the conservation of native westslope cutthroat trout (Allendorf and Leary 1988). Westslope cutthroat trout is substantially reduced in its historic range. Although several studies have determined that genetically pure westslope cutthroat trout populations remain in less than 2.5% of the native range in Montana, little has been done in Idaho. Strong and genetically pure populations are thought to exist in less than 4% of the native range in Idaho (Rieman and Apperson 1989). Introduced rainbow trout, Yellowstone cutthroat trout, and golden trout will freely hybridize with westslope cutthroat trout, producing fertile offspring. This extensive hybridization will infuse exotic genes into the native populations, permanently altering its genetic composition and reducing survival and fertility (Leary et al. 1995). The North Fork Clearwater River is thought to have relatively strong populations of westslope cutthroat trout, however, rainbow and Yellowstone cutthroat trout have been widely introduced in the drainage. Ball and Pettit (1974) report the movement of hatchery stocked rainbow trout from Dworshak Reservoir to Kelly Creek, 88 km upstream. This extensive movement of hatchery rainbow trout in the basin indicates a threat to the indigenous westslope cutthroat trout in more than 75% of the drainage. Previous research strongly suggests that the Dworshak Reservoir mitigation program is causing a permanent, negative impact on westslope cutthroat trout populations. To prevent introgression, rainbow trout should not be stocked wherever native cutthroat trout populations exist, and mitigation programs should develop a local, native cutthroat trout broodstock from several populations within the drainage (Leary et al. 1995).

HYPOTHESIS TO BE TESTED:

Null Hypothesis: Introgression of westslope cutthroat trout with exotic trout (rainbow trout, Yellowstone cutthroat trout, golden trout) has not occurred within the North Fork Clearwater drainage. Alternative Hypothesis: Introgression of westslope cutthroat trout with exotic trout has occurred in the North Fork Clearwater basin, altering the genotype and potentially causing extinction of the native westslope cutthroat trout.

ALTERNATIVE APPROACHES:

No known alternative approaches.

JUSTIFICATION FOR PLANNING:

N/A. This is an on-the-ground project that integrates adaptive management and has direct management implications for resident fish mitigation.

METHODS:

Non-coding nuclear DNA sequences will be used to detect introgression. A reference sample will be created to differentiate westslope cutthroat trout (known pure), westslope cutthroat trout from McCall Hatchery (used to stock much of the drainage and shown to have 2% rainbow trout genes), steelhead from Dworshak National Fish Hatchery (genotype is presumed to exist in a residualized life history form since the completion of Dworshak Dam), Arlee and Shasta strains of rainbow trout (introduced into Dworshak Reservoir as resident fish mitigation), Henry's Lake cutthroat trout (widely introduced into headwater lakes in the drainage). The nuclear DNA markers will be correlated with protein electrophoresis to ensure accuracy. In the field, tissue samples will be collected as fin clips from 25 cutthroat, rainbow, or hybrid trout at each site. Sites will be selected for a representative sample throughout the free-flowing portions of the drainage and for monitoring potential. We will be looking for genetically pure westslope cutthroat trout subpopulations that may be able to reproductively support other populations in an area, as discussed in the metapopulation concept. Finding genetically pure populations of westslope cutthroat trout will be important for protecting the remaining, genetically unaltered populations, and for re-establishing pure populations in introgressed areas of the drainage. We plan to sample 90-100 sites in the drainage by 1999.

PLANNED ACTIVITIES

SCHEDULE:

Planning Phase **Start** 09/95 **End** 05/97 **Subcontractor** Univ.of Montana

Task Research stocking histories and current fish distribution data for the drainage. This information will be used to: identify trout that will be included in the reference sample, classify the genetic status of areas in the drainage, select sites, and interpret results. Select appropriate genetic methodology, secure a sub-contractor for the genetic lab work, and create the necessary genetic reference sample.

Implementation Phase **Start** 06/97 **End** 03/00 **Subcontractor** Univ.of Montana

Task Collect and genetically analyze tissue samples from 90-100 sites in the North Fork Clearwater drainage. Determine the accuracy of visual characteristics in detection of introgression. Collect and statistically analyze habitat parameters at each site.

O&M Phase **Start** 1/99 **End** 12/10 **Subcontractor** Univ.of Montana

Task Promote the development of a local westslope cutthroat trout broodstock for mitigation in Dworshak Reservoir. Monitor the genetic integrity of westslope cutthroat trout populations as affected by the introduction of westslope cutthroat trout derived from a local broodstock (visually monitoring the presence of hybrids at several sites, and potentially continuing genetic analysis on a few sites). Re-establish genetically pure westslope cutthroat trout populations in the drainage.

PROJECT COMPLETION DATE:

12/10

CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:

Inability to accurately visually identify cutthroat X rainbow trout hybrids during long-term monitoring may require the continuation of genetic analysis and associated expenses. There may be cooperation and/or logistic constraints with creating a native westslope cutthroat trout broodstock derived from populations in the drainage. Listing of westslope cutthroat trout under the ESA could be a major factor constraining project operations (permits, etc.) and increasing costs.

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

Expected performance of target population or quality change in land area affected:

The genetic status of the North Fork Clearwater westslope cutthroat trout (purity, extent of introgression, introgression source(s)) will be documented for 90-100 sites by June 2000. Resident fish mitigation activities in the North Fork Clearwater drainage, including Dworshak Reservoir will be conducted to conserve the westslope cutthroat trout populations in consideration of the knowledge gained as a result of the inventory. Monitoring of the effects of a locally derived westslope cutthroat trout broodstock will determine the degree of genetic improvement at monitoring sites in the drainage (2005-2010).

Present utilization and conservation potential of target population or area:

There is a limited catch-and-keep fishery (2 trout possession) on the free-flowing areas of the North Fork Clearwater River and tributaries for a portion of the year. The Kelly Creek tributary to the North Fork is catch-and-release only to preserve native westslope cutthroat trout.

Assumed historic status of utilization and conservation potential:

Westslope cutthroat trout were abundant in the drainage in three life history forms (adfluvial, fluvial, and resident). Although they evolved with bull trout, mountain whitefish, steelhead, and salmon, the westslope cutthroat trout maintain a unique genotype. Previous studies have shown that the genetic differences between westslope cutthroat trout and the other subspecies of cutthroat trout is greater than the genetic differences between many species of fish (Allendorf and Leary 1988). The historic utilization potential was probably greater than 1 fish/hr.

Long term expected utilization and conservation potential for target population or habitat:

Over the long term, the goal is to maintain the North Fork Clearwater drainage as a stronghold for genetically pure westslope cutthroat trout that support a sustainable fishery. The utilization goal in the Dworshak Reservoir portion of the drainage is a harvest of 20,000+ westslope cutthroat trout annually, supported by a westslope cutthroat trout stocking program that furthers the subbasin conservation goal. The westslope stocking program would replace the rainbow trout stocking program, and would be based on a local westslope cutthroat trout broodstock.

Contribution toward long-term goal:

Conservation of the genetic integrity of westslope cutthroat trout. Maintenance of a native, resident fishery, and preservation of biodiversity. Evidence to support the development of a local westslope cutthroat trout broodstock from several populations in the drainage for mitigation.

Indirect biological or environmental changes:

N/A - Basic habitat parameters will be measured in concert with genetic sampling. This could indirectly improve land use (forestry) management for the maintenance or improvement of critical habitat parameters.

Physical products:

Genetic detection of degree of introgression for approximately 100 populations of westslope, rainbow, or hybrid trout in the North Fork Clearwater drainage.

Environmental attributes affected by the project:

Indirectly, water temperature, woody debris, pool/riffle structure, shade and substrate composition.

Changes assumed or expected for affected environmental attributes:

Indirectly, cooler summer temperatures, decreased substrate imbeddedness, more streamside shade, and greater habitat diversity.

Measure of attribute changes:

N/A

Assessment of effects on project outcomes of critical uncertainty:

Due to time and expense, restoration by introduction of pure fish will not be practical for populations that are introgressed with a high percentage of foreign genes (>50%) (Leary et al. 1995). Should these populations be highly introgressed, eradication with subsequent reintroduction of pure fish would be the best management option. However, eradication would incur additional costs. If this point is reached, a decision on practical and affordable management options will need to be addressed by the cooperating organizations. Furthermore, should pure westslope cutthroat trout populations only occur in the extreme headwater areas, such as isolated habitat upstream of fish barriers, an alternate source of westslope broodstock may need to be considered due to genetic isolation and/or genetic drift associated with these populations. Often these isolated populations maintain unique genetic divergence exhibited in the form of a loci and/or frequency not found in adjacent populations (Leary et al. 1995). In this case, we would need to consider adjacent drainages for the broodstock source, or a combination of the remaining, genetically pure isolated populations with westslope cutthroat trout from another drainage. Should we encounter either of the above possibilities, we will

need to adjust with some biologically feasible option considering the results of the genetic inventory.

Information products:

A genetic inventory of the extent of introgression by exotic trout in the drainage for approximately 100 sites. Monitor the benefits of a local, native westslope cutthroat trout broodstock to the re-establishment of genetically pure westslope cutthroat trout populations.

Coordination outcomes:

Support the development of a native westslope cutthroat trout broodstock from several populations within the drainage for the mitigation program. This will require cooperation with the Army Corps of Engineers, Idaho Fish and Game, and Dworshak National Fish Hatchery.

MONITORING APPROACH

Genetic status for points in the drainage will be detected from tissue samples collected at sites in the North Fork Clearwater drainage. A population estimate will be made for each site, reflecting the abundance of a particular genetic status (i.e. genetically pure but low abundance). Visual identification criteria (such as spot pattern, jaw length, gular slashes, and parr marks) will be investigated for success of identifying hybrids. Monitoring the affect of a native westslope cutthroat trout broodstock derived from genetically pure trout in the drainage used in mitigation.

Provisions to monitor population status or habitat quality:

Genetic markers are developed to detect introgression between westslope cutthroat trout, rainbow trout, Yellowstone cutthroat trout, and golden trout. Management options such as restoration, genetic swamping, and eradication have been tested on cutthroat trout populations in Montana.

Data analysis and evaluation:

The genetic status of each site will be mapped and related to stocking histories. Significant genetic differences will be tested between and within populations with a G test. The removal method will be used to calculate population estimates and standard deviations for 50 meter sites. Visual characteristics (spot pattern, upper jaw length, presence/absence gular slashes, etc.) will be analyzed with discriminant function analysis after individual trout are genetically identified. Some habitat parameters will be measured at each 50 meter site and will be correlated with species distribution and abundance using multiple regression analysis.

Information feed back to management decisions:

Genetic status detected from samples in the drainage will be used to support the need for a locally derived westslope cutthroat trout broodstock for mitigation in the drainage. This information will be provided directly to agencies (Corps of Engineers/BPA) with direct mitigation implementation responsibilities.

Critical uncertainties affecting project's outcomes:

Fluvial and adfluvial life forms of cutthroat trout contribute more to the fishery because they attain larger sizes and utilize more desirable angling habitat. Due to stocking practices, the genetic purity of fluvial and adfluvial life history forms of westslope cutthroat trout may be more vulnerable than the resident form. Therefore, the identification of the different life history forms (adfluvial, fluvial, and resident) would support the genetic findings of this study (i.e. the extent of introgression in these life history forms, the extent of spawning migrations and seasonal movements of fluvial and adfluvial westslope cutthroat trout, and whether these spawning sites are also utilized by rainbow trout).

EVALUATION

Location of introgressed and/or pure populations of westslope cutthroat trout for approximately 100 sites in the North Fork Clearwater drainage. Participation in mitigation decisions affecting the drainage. Substantive transition from introduced rainbow trout stocking to westslope cutthroat trout.

Incorporating new information regarding uncertainties:

If introgression has progressed beyond the point of restoration, we will evaluate the effectiveness of management options (such as eradication, and restoration by genetic swamping) used in similar Montana streams.

Increasing public awareness of F&W activities:

The project work statement includes a creel census to determine salmonid catch rates in high use areas of the free-flowing portion of the drainage. The creel census will require the technicians and biologists working on the project to interview anglers, and discuss the negative affects of hybrids to the native cutthroat trout populations. Furthermore, we have considered signs at access points and trailheads that will describe what cutthroat trout, rainbow trout, and hybrids look like with pictures. If anglers getting proper fish identification information, different angler regulations for rainbow and cutthroat trout in the drainage could aid eradication attempts. Technical reports will also increase the public awareness of efforts to enhance and protect fisheries in the drainage.

RELATIONSHIPS**RELATED BPA PROJECT**

9405400

8740700 Dworshak Impacts/M&E & Bio-int Rule Curves

RELATIONSHIP

Project 9405400 is using similar genetic methods and the same sub-contractor to evaluate the genetic structure of bull trout in Oregon

NPPC approved the authorizing measure for project 9501600 based on recommendations from project 8740700; both projects will address the effects of mitigation of Dworshak Dam

OPPORTUNITIES FOR COOPERATION:

Measure 10.3C.7 includes cost-sharing from the Corps of Engineers for monitoring and evaluation of its resident fish mitigation stocking program, including impacts on native westslope cutthroat trout.

COSTS AND FTE**1997 Planned:** \$167,300**FUTURE FUNDING NEEDS:**

<u>FY</u>	<u>\$ NEED</u>	<u>% PLAN</u>	<u>% IMPLEMENT</u>	<u>% O AND M</u>
1998	\$202,000	10%	90%	0%
1999	\$190,000	20%	70%	10%
2000	\$202,000	20%	10%	70%
2001	\$218,000	10%	20%	70%
2002	\$226,500	10%	20%	70%

PAST OBLIGATIONS (incl. 1997 if done):

<u>FY</u>	<u>OBLIGATED</u>
1995	\$183,782
1997	\$163,992
TOTAL:	\$347,774

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

LONGER TERM COSTS:

We expect to continue the project until Dec. 2010. The annual costs for the years after 2002 will range from \$230,000 to \$260,000 not including inflation increases.

Continue long-term monitoring of the genetic improvements to introgressed cutthroat trout populations from stocking with genetically pure, native, westslope cutthroat trout from the drainage.

1997 OVERHEAD PERCENT: 29.5%**HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:**

Applies to personnel and operating costs only.

SUBCONTRACTOR FTE: .5
